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**A4F FD11 F30X**

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**US 5836031 A**

**US 5768738 A**

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(54) Abstract Title

**Optical fibre connector cleaner**

(57) A device for cleaning optical fibre connectors comprising a length of cleaning sheet 4 held between a reel 22 and a winding pulley 2 within a case 1c. A portion of the cleaning sheet 4 is exposed through a window (7, Fig.4) in the case 1c for cleaning. A lever 6 in the form of a pivoted inclining wall of the case is attached to a rotating mechanism for advancing the cleaning sheet 4 between the reel 22 and the winding pulley 2 to expose fresh cleaning sheet 4 in the window (7, Fig.4).

**FIG. 6**

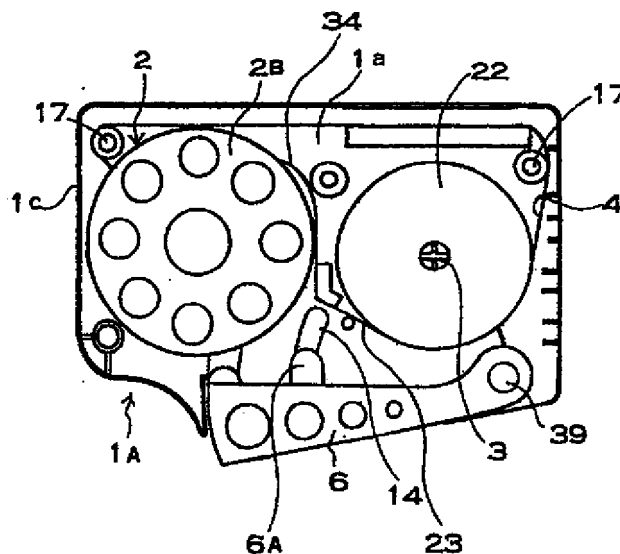


FIG. 1

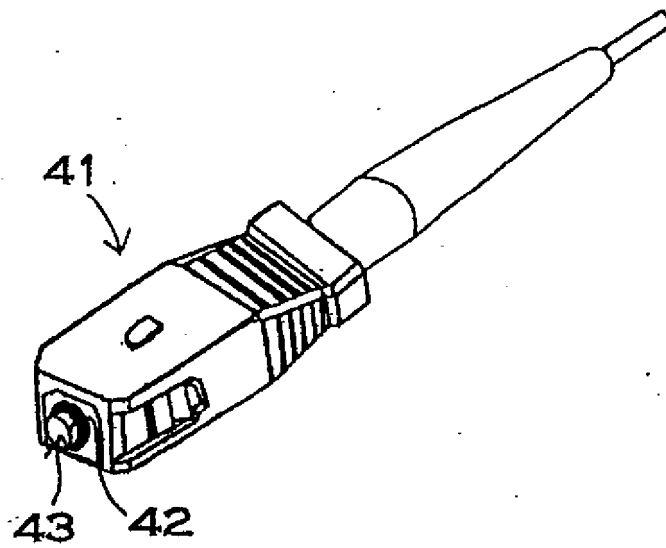


FIG. 2

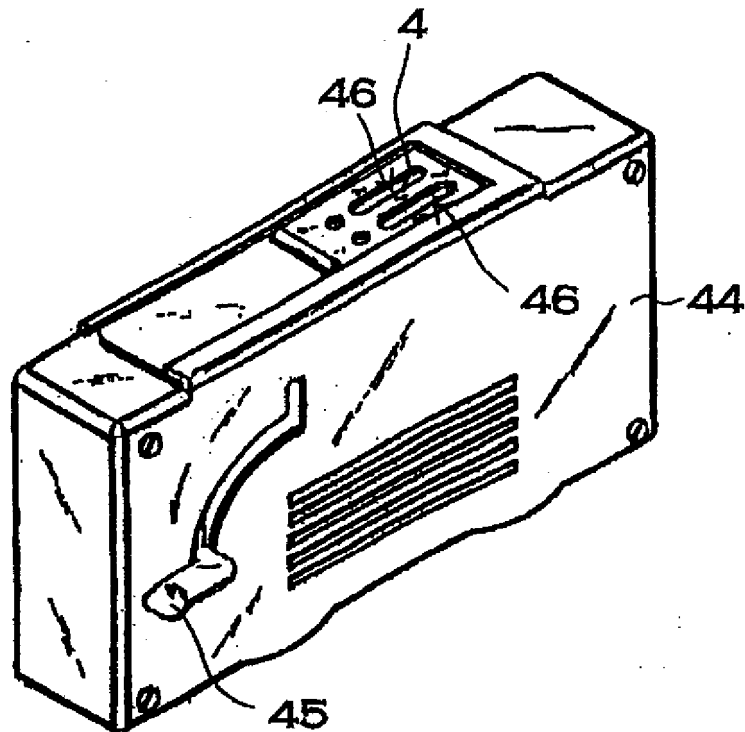


FIG. 3

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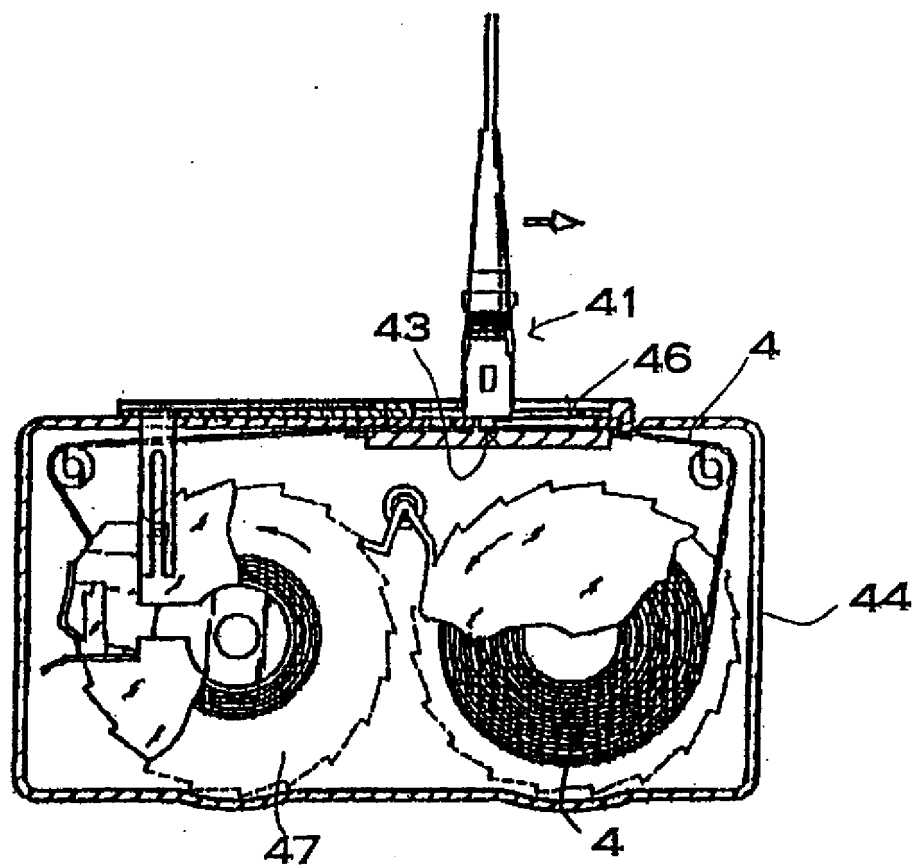


FIG. 4

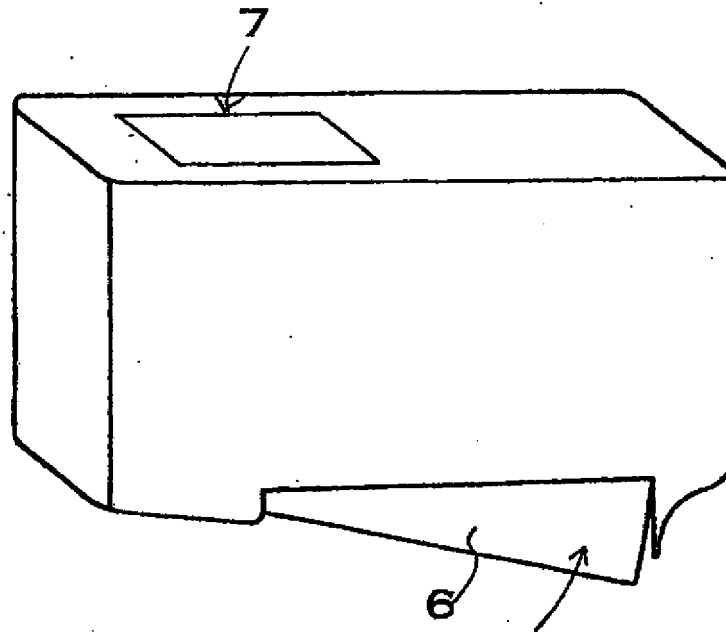


FIG. 5

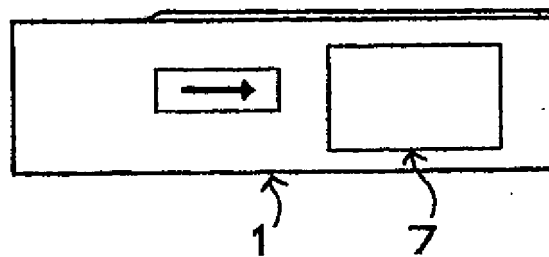


FIG. 6

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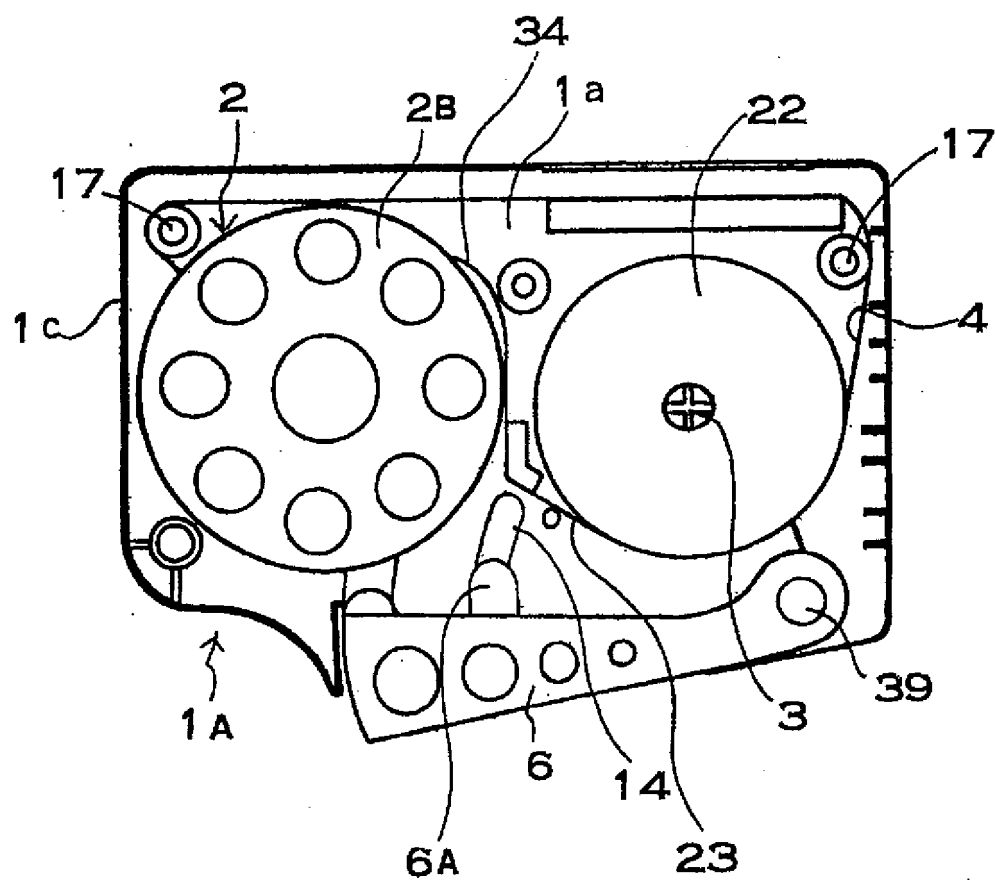


FIG. 7

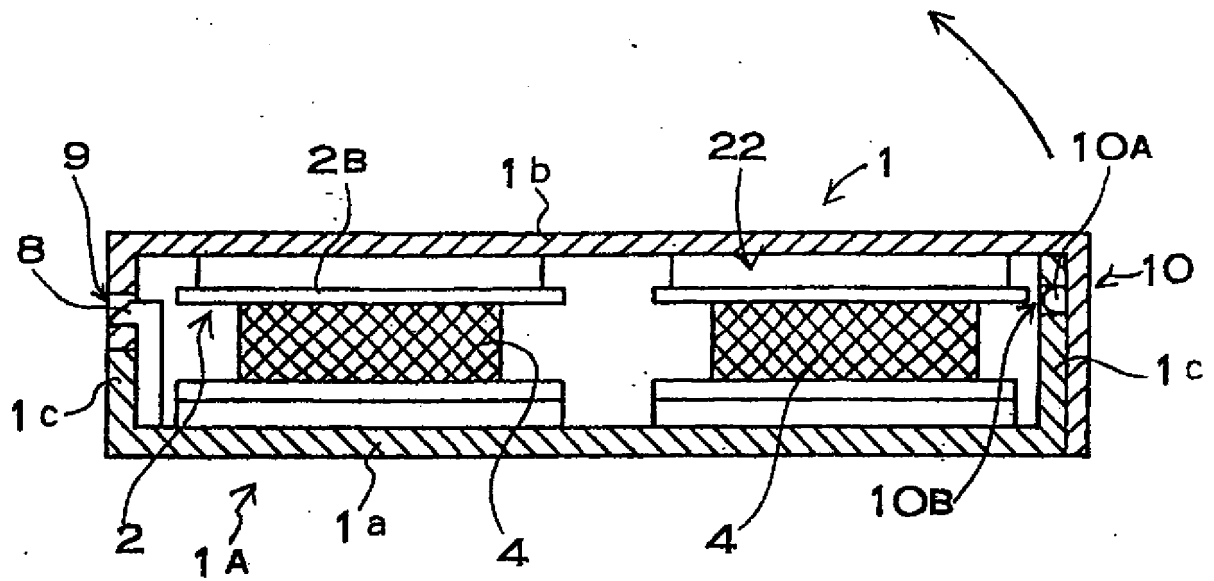


FIG. 8

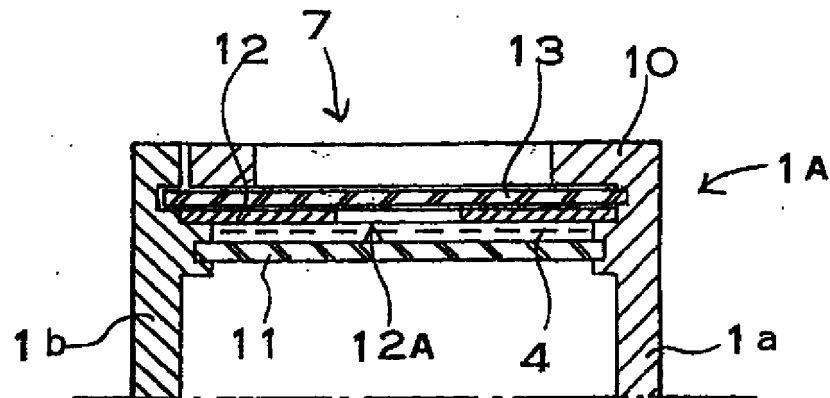


FIG. 9

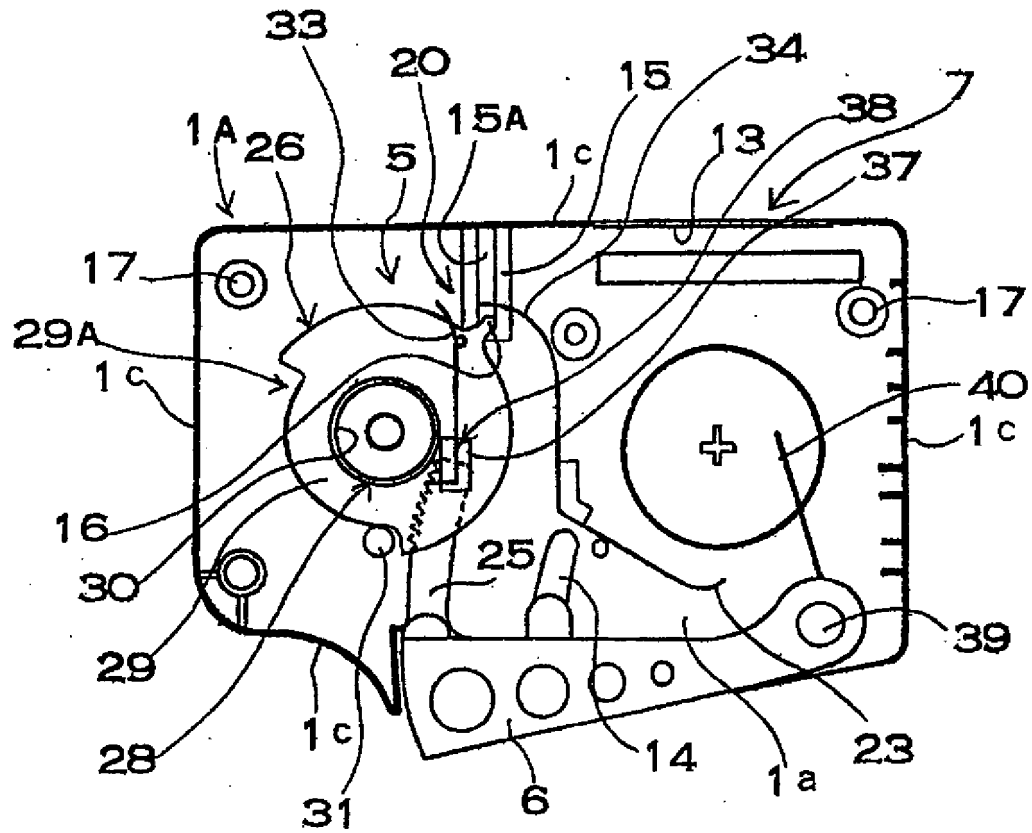


FIG. 10

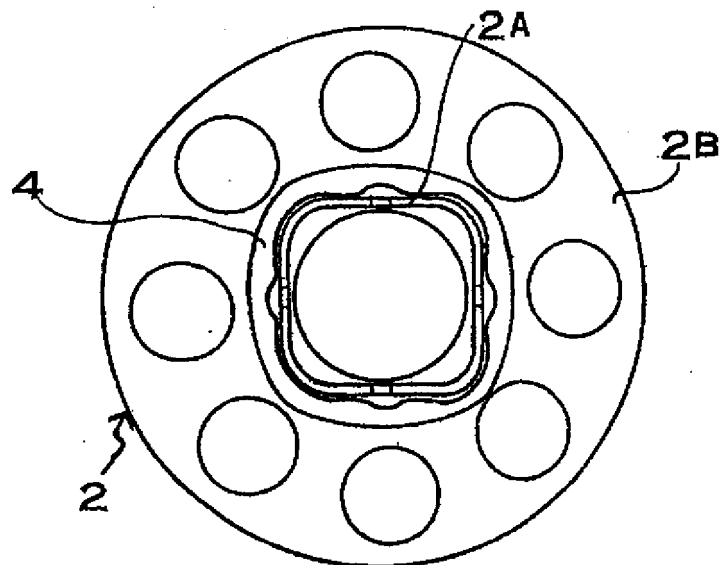


FIG. 11

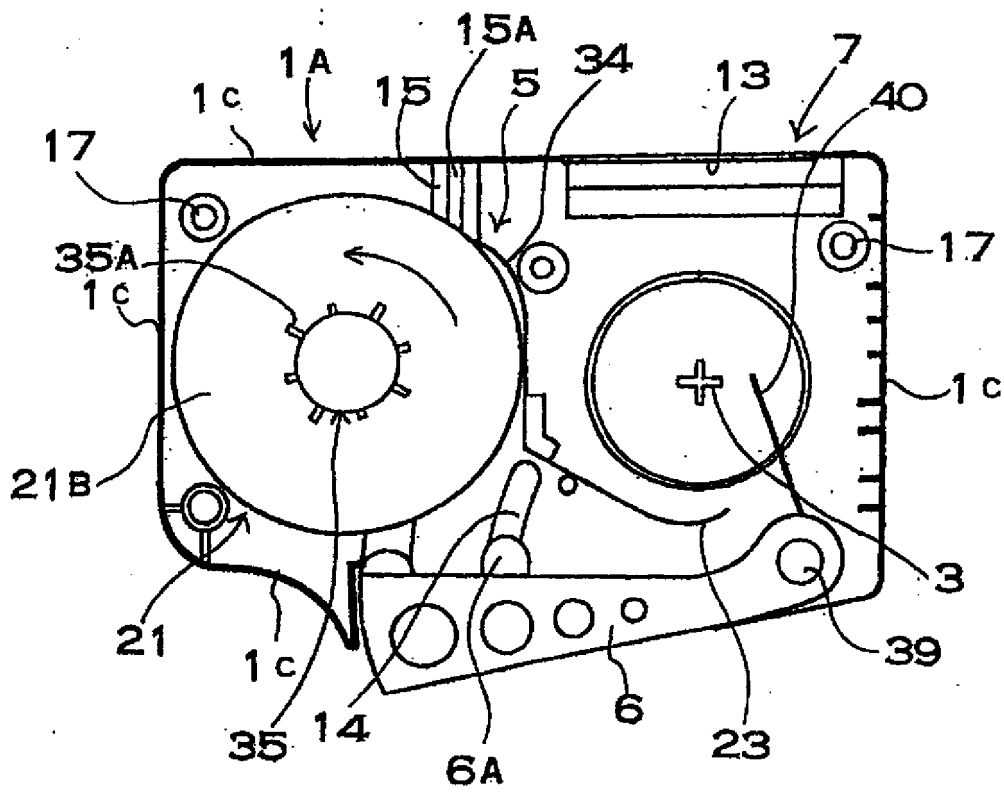


FIG. 12

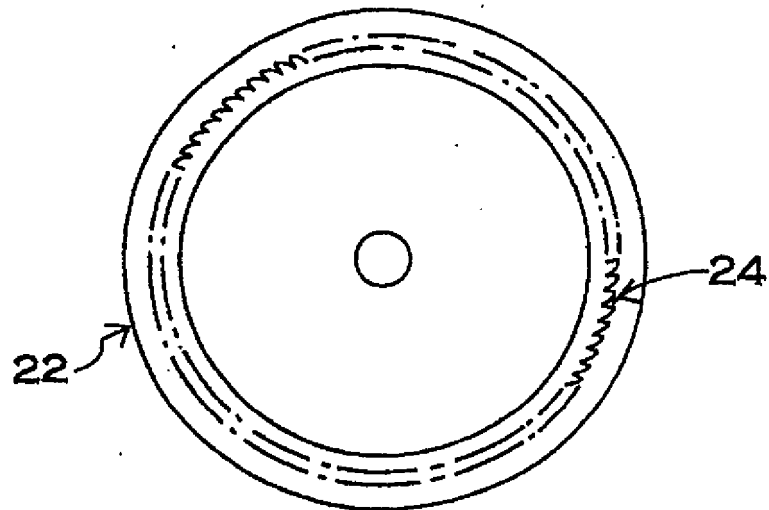




FIG. 13

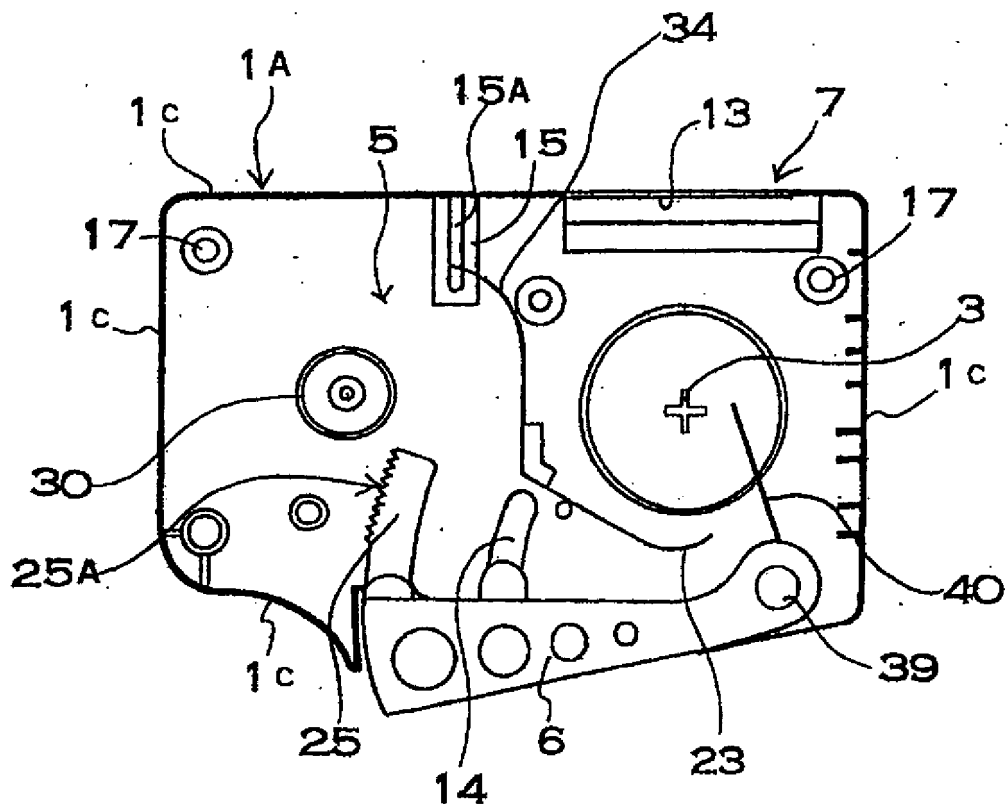
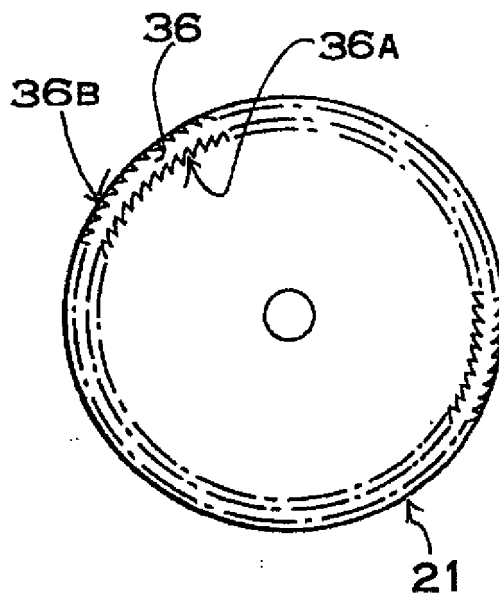


FIG. 14



## TITLE OF INVENTION

### Cleaning Tool for optical fiber connectors

This application is based on application No. 058814 filed in Japan on Mar. 3, 2000, the  
5 content of which incorporated hereinto by reference .

## BACKGROUND OF THE INVENTION

This invention relates to a cleaning tool for removing dirt and foreign material from  
optical fiber connectors to make them clean.

10 An optical fiber connector has a connecting surface exposed at its end. The  
optical fiber connector 41 shown in Fig. 1 has optical fiber fixed at the center of a zirconia  
ceramic ferrule 42, and its connecting surface 43 is polished to a mirror surface. Optical  
fiber connectors of this configuration are joined with connecting surfaces in mutual  
opposition to transmit optical signals. If the connecting surfaces are dirty or foreign  
15 material is attached to the connecting surfaces when a pair of optical fiber connectors are  
joined, optical signals cannot be transmitted properly. This is because a dirty surface or  
foreign particles will block or reflect light in the optical fiber.

To avoid this problem it is necessary to clean the connecting surfaces then join  
optical fiber connectors. The cleaning tool shown in Fig. 2 has been developed as a tool  
20 for cleaning optical fiber connectors (Japanese Reaid-open Patent Publication TOKU-KAI-  
HEI 6-242,347, 1994). Fig. 3 shows the internal structure of the cleaning tool of Fig. 2 with  
the case 44 opened. As shown in Fig. 3, cleaning sheet 4 is wound around pulley 47 in  
the form of tape inside the case 44. Cleaning sheet 4 is wound by operation of a lever 45  
provided on the case 44, and it moves cleaning sheet 4 which is exposed in windows 46

through the case 44. Each time the lever 45 is operated, new cleaning sheet 4 is exposed in the windows 46. Therefore, an optical fiber connector connecting surface can be polished clean by rubbing the connecting surface against the cleaning sheet 4 exposed through the windows 46.

5           The cleaning tool shown in Fig. 2 is capable of cleaning optical fiber connecting surfaces with the cleaning sheet, but it limits operator's hands to use it. The cleaning tool shown in Fig. 2 is used with operating the lever by thumb of left hand so that right-handers can use it. The structure of the cleaning tool is not capable to be used with operating by right hand for left-handers. It is a drawback to make difficult to be used for left-handers.

10           In addition, the cleaning tool shown Fig. 2 has another drawback that projecting lever from the case makes a storage outer case larger. Further, the cleaning tool shown in Fig. 2 has another drawback, which dirt and dust can enter into the case through the slit then they attach to the cleaning sheet, since the cleaning tool shown in Fig. 2 has an opened circular arc shaped slit to rotate the lever. If dirt attaches to the cleaning sheet, it  
15           can attach to a connecting surface when the optical fiber connector is rubbed against the cleaning sheet, and disrupt light transmission. In particular, dirt does not attach to the portion of the cleaning sheet which is wound tightly in a roll, but a portion of the cleaning sheet is unwound and exposed within the case for the purpose of transfer and delivery.

          The present invention has developed to further solve these types of problems and  
20           drawbacks. Thus it is a primary object of the present invention to provide a cleaning tool for optical fiber connectors, which can be used for every operator conveniently, can be held compactly and can has a structure to prevent dirt and dust to be entered into the case.

          The above and further objects and features of the invention will more fully be

apparent from the following detailed description with accompanying drawings.

## SUMMARY OF THE INVENTION

The cleaning tool for optical fiber connectors of the present invention has a case  
5 formed in a box shape which exposes a part of a cleaning sheet disposed inside in a  
window for cleaning, a winding pulley winding the cleaning sheet disposed inside of the  
case in a constant pitch, a rotating mechanism rotating the winding pulley, and a lever  
operating the rotating mechanism. Further, the cleaning tool of the present invention has  
all elements below;

10 The case has a form that is closed off a outline of a first front plate and a second front  
plate with a perimeter wall, disposes the cleaning sheet and the winding pulley between  
the first front plate and the second front plate of the case. The case defines an opened  
portion partially in the perimeter wall, and the lever is disposed in the opened portion to be  
inclinable. The lever is attached to the case to be able to incline around a incline axis  
15 rectangular to the surfaces of the first front plate and the second front plate. Operating the  
lever to incline rotates the winding pulley by the rotating mechanism, and winding the  
cleaning sheet of the winding pulley moves the cleaning sheet in the window for cleaning.

The cleaning tool for optical fiber connectors described above has the  
advantageous feature that it can be used for every operator conveniently, regardless  
20 right-handers or left-handers. It causes that operators can hold the upper surface with  
their thumbs that has window for cleaning, and can hold the bottom side with other fingers.  
The case of the cleaning tool of the present invention, which is held in such manner for  
using, can be held either by right hand or left hand equally for use. In particular, the  
cleaning tool of the present invention has the feature that it can be used easily compared

with a related art cleaning tool, since it is be operated with holding on the upper surface with operators' thumbs and holding the lever with the other fingers, not with holding the lever with operators' thumbs such as a related art cleaning tool.

In addition, the cleaning tool for optical fiber connectors described above has further advantageous feature that its overall width can be substantially same as the case width, and it achieves to be held in a more compact storage case or the like, since it is not necessary for the lever to project from the side of the case contrary to a prior art cleaning tool and the lever is disposed in the opened window on the perimeter walls to be able to incline.

Further, the cleaning tool for optical fiber connectors described above has the feature that it has the structure to close off the opened window in the perimeter walls by the lever and decrease dirty by preventing dirty and dust to enter into the case.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an oblique view showing an optical fiber connector.

Fig. 2 is an oblique view showing a related art cleaning tool for optical fiber connectors.

Fig. 3 is a front view showing the cleaning tool for optical fiber connectors of Fig. 2 with the case open.

Fig. 4 is an oblique view showing an embodiment of the cleaning tool for optical fiber connectors of the present invention.

Fig. 5 is a plan view of the cleaning tool for optical fiber connectors shown in Fig.

4.

Fig. 6 is a front view of the cleaning tool for optical fiber connectors shown in Fig.

4 with the case opened.

Fig. 7 is a cross section view of the cleaning tool shown in Fig. 4 with the case open-close status.

Fig. 8 is a cross section view of window for cleaning of the cleaning tool shown in  
6 Fig. 4

Fig. 9 is a front view of the cleaning tool shown in Fig. 4 with the case opened and the ratchet pulley removed.

Fig.10 is a bottom view of the winding pulley.

Fig. 11 is a plan view of the cleaning tool shown in Fig. 4 with the case opened  
10 and the ratchet pulley removed.

Fig. 12 is a bottom view of the feeding pulley.

Fig. 13 is a plan view of the cleaning tool shown in Fig. 4 with back-and-forth rotating pulley removed.

Fig. 14 is a bottom view of the ratchet pulley of the cleaning tool shown in Fig. 4.  
15

#### DETAILED DESCRIPTION OF THE INVENTION

The cleaning tool for optical fiber connectors shown in the oblique view of Fig. 4, the plan view of Fig. 5 and the front view with the case 1 opened of Fig.6 has a case 1, a winding pulley 2 winding a cleaning sheet 4 attached inside of the case 1 in a constant  
20 pitch, a rotating mechanism 5 rotating the winding pulley 2 and a lever 6 operating the rotating mechanism 5.

The case 1 has a box shaped case formed with a first front plate 1a and a second front plate 1b, whose outline is closed off by a perimeter walls 1c. The cleaning sheet 4 and the winding pulley 2 are disposed between the first front plate 1a and the second

front plate 1b in the case 1. The overall form of the cleaning tool shown in these figures is formed in approximately rectangular shapes. The case 1 has the lever 6 to be able to incline in an opened portion in the perimeter wall 1c that is opened through a lower surface in Fig. 6. In addition, the case 1 has a window for cleaning 7 that is opened  
5 through an upper surface in Fig.6 to expose the cleaning sheet 4 partially.

The case 1 has a structure that can open for exchanging the cleaning sheet 4. A main case 1A is provided with the first front plate 1a formed integrally with the perimeter wall 1c. The case 1 has the main case 1A and the second front plate 1b that joins to the main case 1A removably. Fig. 7 shows the structure that can join the second front plate 1b  
10 with the main case 1A removably. In the case 1 shown in Fig. 7, a plurality of hinge hooks 8 are disposed with predetermined pitch and formed integrally with the main case 1A. Retaining holes 9 that guide the hinge hooks 8 are opened through a lower sidewall provided at the second front plate 1b. In addition, male and female stoppers 10 are disposed on the opposite sidewall of the second front plate 1b. In the stoppers 10 shown  
15 In Fig. 7, the male stopper 10A are disposed with projecting on the sidewall of the second front plate 1b, and female stopper 10B retaining the male stopper 10A to be inserted are disposed on the perimeter wall 1c of the main case 1A.

The case 1 with this structure is openable by releasing the male and female stoppers 10, then inclining the second front plate 1b toward the direction shown by the  
20 arrow and the main case 1A is opened. Also the second front plate 1b is detachable from the main case 1A by releasing the retaining holes 9 from the hinge hooks 8.

The window for cleaning 7 is disposed with being opened through the perimeter wall 1c in a form of rectangular. As shown the cross section view of Fig. 8, a holding plate 11 holding the back of the cleaning sheet 4 is disposed inside of the window for cleaning 7.

In addition, an intermediate window sheet 12 and a shutter 13 are disposed in the front side of the cleaning sheet 4. The holding plate 11 is disposed horizontally inside of window for cleaning 7, with its both edge joining to insertion grooves of the first front plate 1a and the second front plate 1b. The holding plate 11 is larger than the opening area of the window for cleaning 7, and closes off the window for cleaning 7 wholly inside.

The intermediate window sheet 12 is disposed horizontally in the front side of the holding plate 11. The intermediate window sheet 12 is also disposed with its both edge joining to the insertion grooves of the first front plate 1a and the second front plate 1b. The intermediate window sheet 12 has an opened window 12A at the center. A passing space is formed between the intermediate window sheet 12 and the holding plate 11 to pass the cleaning sheet 4. The cleaning sheet 4 is exposed through the opened window 12A of intermediate window sheet 12, so that the optical fiber connector can be cleaned at this portion. The opened window 12A thus opens in the form of rectangle, which extends along with feeding direction of the cleaning sheet 4. The opened window 12A has sufficient width and length so as to clean the edge of the optical fiber connectors guided there and feed toward its longitudinal direction.

The shutter 13 closes the window for cleaning 7 when the cleaning tool is not in use. When the cleaning tool is in use, i.e., when cleaning the optical fiber connectors, it opens by operating the lever 6. As shown the cross section view in Fig. 8, the shutter 13 is guided its both edge by guide groove 14 formed on the inner surface of the first front plate 1a and the second front plate 1b to be slidable, for moving along the inner surface of the perimeter wall 1c which opens window for cleaning 7.

In addition, the rotating mechanism 5 moves the shutter 13 by operating the lever 6. To achieve this, as shown the front view of Fig. 9, the shutter 13 connects to a slit arm



15 having a slit 15A to connect to a crankpin 16 of the rotating mechanism 5. The slit arm 15 forms the slit 15A extended in the direction traversing the shutter 13 opening direction, since the shutter 13 is opened and closed horizontally in Fig. 9, so that the slit 15A is extended vertically. The shutter 13 is bent one end of a metal sheet, and forms the slit arm 15.

Further, the case 1 of Fig. 9 has a idle roller 17 connected with the inner surface of the first front plate 1a for guiding the cleaning sheet 4 into a predetermined position.

Rotating mechanism 5 rotates the winding pulley 2 in one direction. The winding pulley is made of plastics. The winding pulley 2 of Fig. 10 is formed integrally with slit axis 2A and a disciform outer plate 2B. The slit axis 2A has a plurality of row of slits extended in direction of the axis. The winding pulley 2 joins to a ratchet pulley 21 of ratchet mechanism 20 shown in Fig. 11 not to rotate freely. Projections 35A of a spline axis 35 of ratchet pulley 21 is guided to the slit of the slit axis 2A, and then the winding pulley 2 is connected with the ratchet pulley 21 not to rotate freely. The winding pulley 2 attached to the ratchet pulley 21 winds the cleaning sheet 4 between the disciform outer plate 2B and a disc 21B of the ratchet pulley 21.

The rotating mechanism 5 rotates the winding pulley 2 of this structure to wind the cleaning sheet 4 with attaching to the ratchet pulley 21. In addition, the winding pulley 2 is removable from the ratchet pulley 21, after it winds up the cleaning sheet 4. It has the feature that the cleaning sheet 4 wound around the winding pulley 2 after using up can be thrown away easily, with winding pulley 2 removing from the ratchet pulley 21. It causes that the winding pulley of this structure has the outer plate 2B in only one side of the slit axis 2A so that the cleaning sheet wound up can be removed along the slit axis 2A easily. On contrast with a related art cleaning tool, since the winding pulley has the outer plates

in both side, the cleaning sheet wound up cannot be removed from the winding pulley easily, so that the winding pulley with the cleaning sheet wound up after using is thrown away. Accordingly, as shown in Fig. 10, the winding pulley 2 that can be removed in separate can allow that only the cleaning sheet is thrown away and recyclable, so that it has the feature of manufacturing in low cost and reducing the wastes extremely.

The case 1 has a feeding axis 3 formed integrally on the first front plate 1a made of plastic to set the cleaning sheet 4 at the predetermined position. The feeding axis 3 is formed columnar with crisscross in the cross section view. The cleaning sheet 4 is attached to the feeding axis 3 directly or via the feeding pulley so as to rotate the cleaning sheet 4.

10 The cleaning sheet attached to the feeding axis 3 via a feeding pulley with the structure attaching the feeding pulley not to reverse has the feature that it prevent the cleaning sheet 4 from sagging.

The feeding pulley 22 is attached to the feeding axis 3 not to reverse by a reverse preventing arm 23 connected to the first front plate 1a. As shown in Fig. 12, the feeding pulley 22 with this structure has a reverse preventing gear 24 disposed on the surface, back of the disc 2B, facing to the first front surface 1c. It prevents the feeding pulley 22 from reversing by retaining the reverse preventing gear 24 by the end of the reverse preventing arm 23.

The rotating mechanism 5 has a rack 25 to be moved in reciprocation by the lever 6 connected to the lever 6, a back-and-forth rotating plate 26 having a gear to bite the rack 25 and the ratchet equipment 20 rotating the winding pulley 2 in the fixed rotation by rotating of the back-and-forth rotating plate 26.

The rack 25 is integrally formed with lever 6 made of plastics and connected to the end of the lever 6, in other words, opposite side against a incline axis 39. As shown in

Fig. 13 with the back-and-forth rotating plate 26 removed, the rack 25 is formed plate to move along the surface of the first front plate 1a. The rack 25 has a circular arc shaped gear 25A. An arc of the rack 25 is trace of the lever 6 around the incline axis 39. It causes the rack 25 and a pinion 28 to bite each other when the lever 6 rotates.

5           The back-and-forth rotating plate 26 is made of plastics and formed integrally with a disc plate 29 and the pinion 28. The disc plate 29 has a pierced hole in its center. A round rib 30 formed integrally with the first front plate 1a is inserted into the pierced hole so as to connect the first front plate 1a with the back-and-forth rotating plate 26 rotatably.

10           In addition, the disc plate 29 has a crankpin 16 to open and close the shutter 13 and a circular arc shaped notch 29A on the outline. The circular arc shaped notch 29A guides a positioning projection 31 projected from the first front plate 1a. The positioning projection 31 is guided along the circular arc shaped notch 29A so as to limit the rotating range of back-and-forth. The back-and-forth rotating plate 26 of Fig. 9 has the projected pinion 28 and crankpin 16 projecting from the back side of the disc plate 29.

15           The ratchet equipment 20 has the ratchet pulley 21 for attaching the winding pulley 3, an elastic rotating arm 33 for rotating the ratchet pulley 21 in one direction and a stopper arm 34 preventing the ratchet pulley 21 from rotating in reverse direction. The elastic rotating arm 33 and the stopper arm 34 are made of elastic metal or hard plastic that can deform elastically.

20           The ratchet pulley 21 is integrally formed by plastics overall. The ratchet pulley 21 has a spline axis 35 to attach the winding pulley 2 on the upper surface of the disc 21B as shown a plan view of Fig. 11, and a ratchet ring 36 with ratchet gear around on both inside and outside of the lower surface as shown in Fig. 14. The spline axis 35 is inserted into a slit axis 2A of winding pulley 2. The spline axis 35 guided to the slit of the slit axis 2A are

disposed with extending in direction of the axis, and the spline axis 35 is connected to the slit axis 2A not to rotate.

The end of elastic rotating arm 33 connects to the inner ratchet gear 36A of the ratchet ring 36. The end of stopper arm 34 joins to the outer ratchet gear 36B. The ratchet  
5 ring 36 forms inner ratchet gear 36A with slope such that the inner ratchet gear 36A pushes the elastic rotating arm 33 toward the direction shown by the arrow in Fig. 11 then the inner ratchet gear 36A rotates the ratchet pulley 21, and backing elastic rotating arm 33 is released from its retaining engagement and it moves on the surface of the ratchet gear 36A. In addition, the outer ratchet gear 36B is formed with slope on its back to catch the  
10 end of the stopper arm 34 on it such that the ratchet pulley 21 rotate in direction of the shown arrow while reverse rotation prevented.

As shown in Fig. 9, one end of the elastic rotating arm 33 is connected to the back-and-forth rotating plate 26 such that its top end is connected to the inner ratchet gear 36A of ratchet ring 36 disposed in the ratchet pulley 21 with putting on it. The top end  
15 of the elastic rotating arm 33 is curved relative to direction of the rotation of the inner ratchet gear 36A. It causes to make sure to rotate the ratchet pulley 21 properly to prevent from rotating in wrong direction. The elastic rotating arm 33 of Fig. 9 has a bent portion formed in L-shape at bottom end, and the bent portion is secured on the upper surface of the disc plate 29 of the back-and-forth rotating plate 26. The disc plate 29 has a  
20 retraining rib 37 projecting on the upper surface to connect with the elastic rotating arm 33. The retraining rib 37 forms L-shaped groove to insert the bent portion of the elastic arm 33, and the L-shaped groove joins to the bent portion of the elastic arm 33.

As shown in Fig. 9, the top end of the stopper 34 is curved toward direction of the rotation of the ratchet pulley 21. It causes to rotate the ratchet pulley 21 in proper direction

smoothly and to prevent from reversing. The stopper arm 34 of Fig. 9 is formed integrally with the reverse preventing arm 23 for preventing the feeding pulley 2 attached to the feeding axis 3 from reversing. The middle of the stopper arm 34 and the reverse preventing arm 23 are fixed on the first front plate 1a. The reverse preventing arm 23 is extended to the position to retain a reverse preventing gear 24 disposed on the back of the feeding pulley 22, and the top end of the reverse preventing arm 23 is curved toward direction of rotation of the feeding pulley 22.

The perimeter wall 1c of the case 1 defines an opened portion in lower part in Fig. 6 and Fig. 9. The lever 6 is disposed at the opened portion to be able to incline. The lever 6 is attached to in the case 1 be able to incline around the incline axis 39 rectangular to the surfaces of the first front plate 1a and the second front plate 1b, the incline axis 39 rectangular to surface of this paper in Fig. 9. The incline axis 39 is disposed at the corner of the case 1 and formed integrally with the case 1. A axis hole of the lever 6 is inserted to the incline axis 39, and the lever 6 is attached to the incline axis 39 with a screw not to be fallen out.

The lever 6 is thrust toward direction to project from the opened portion by an elastic part 40 when the lever 6 is not operated by hand. The loop portion of the middle of the elastic part 40 of the figures is inserted to the incline axis 39. The elastic part 40 is a metal leaf spring whose one end joins to the first front plate 1a and the other end joins to the lever 6. The elastic part can be used anything that thrusts the lever 6 toward thrusting direction.

The lever 6 has a projection 6A projecting in the first front plate 1a side to limit incline angle. The first front plate 1a has a circular arc shaped guiding groove 14 to guide projection 6A. The projection 6A can touch both end of the guiding groove 14, then incline

angle of the lever 6 can be limited.

The cleaning tool for optical fiber connectors described above is used to clean the optical fiber connector in the way described below;

1. With opening the second front plate 1b of the case 1, set the feeding pulley 22  
5 to the feeding axis 3, then set the cleaning sheet 4 to the feeding pulley 22.

2. Pull out the cleaning sheet 4 from the feeding pulley 22, put it onto an idle roller 17, then pass it between the shutter 13 and the holding plate 11, join the end of the cleaning sheet 4 to the winding pulley.

3. Close the second front plate 1b.

10 4. Press the lever 6, and then the lever rotates the back-and-forth rotating plate 26 via the rack 25. The back-and-forth rotating plate 26 rotates the ratchet pulley 21 via the elastic rotating arm 33, and rotates the winding pulley 2 attached to the ratchet pulley 21. Therefore, the winding pulley 2 winds the cleaning sheet 4 in constant length. When pulling out the cleaning sheet 4, the feeding pulley 22 rotates in direction to feed the  
15 cleaning sheet 4.

5. The back-and-forth rotating plate 26 in rotating opens the shutter 13 via crankpin 16. At the this time, the crankpin 16 of the back-and-forth rotating plate 26 slides in the slit of the slit arm 15, pull the shutter 13 toward rotating direction via slit arm 15 and opens the window for cleaning 7. Then the optical fiber connectors are cleaned by the  
20 cleaning sheet 4 exposed in the window for cleaning 7.

6. After cleaning the optical fiber connector, stop pressing the lever 6, and then the elastic part 40 pushes back the lever 6 to the original position. At this time, the rack 25 joining to the lever 6 moves in opposite direction of pressing the lever 6, and reverses the back-and-forth rotating plate 26.

7. The back-and-forth rotating plate 26 in reversing moves the elastic rotating arm 33 joining to the back-and-forth rotating plate 26 along the surface of the inner ratchet gear 36A of the ratchet pulley 21. The ratchet pulley 21 retains the end of the stopper arm 34 to prevent reversing.

5           At this time, the crankpin 16 of the back-and-forth rotating plate 26 moves in the slit of the slit arm 15, and moves the shutter 13 in direction to close.

          As this invention may be embodied in several forms without departing from the spirit of essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims 10 rather than by the description preceding them, and all changes that fall within meets and bounds of the claims, or equivalence of such meets and bounds thereof are therefore intended to be embraced by the claims.

## CLAIMS

1. A cleaning tool for optical fiber connectors comprising:

a cleaning sheet;

5 a case formed in a box shape, which retains the cleaning sheet inside and exposes a part of the cleaning sheet in a window for cleaning, having a form that is closed off a outline of a first front plate and a second front plate with a perimeter wall;

a winding pulley disposed between the first front plate and the second front plate of the case, winding the cleaning sheet in a constant pitch;

10 a rotating mechanism rotating the winding pulley; and

a lever joined to the rotating mechanism, disposed in an opened portion formed in the perimeter wall of the case to be able to incline, and attached to the case to be able to incline around a incline axis rectangular to the surfaces of the first front plate and the second front plate;

15 wherein

operating the lever to incline rotates the winding pulley by the rotating mechanism, and winding the cleaning sheet of the winding pulley moves the cleaning sheet in the window for cleaning.

20 2. The cleaning tool for optical fiber connectors according to claim 1,

wherein

both the first front plate and the second front plate are in oblong shape, and the perimeter wall defines the opened portion for disposing the lever at the one of the longer side of the oblong rectangular.



3. The cleaning tool for optical fiber connectors according to claim 2,

wherein

the lever is attached in the case to be able to incline around the incline axis located at  
5 corner area of the case.

4. The cleaning tool for optical fiber connectors according to claim 1,

wherein

the opened portion for disposing the lever to be able to incline is positioned in the  
10 opposite side of the case relative to the window for cleaning for exposing a part of the  
cleaning sheet.

5. The cleaning tool for optical fiber connectors according to claim 1,

wherein

15 the case has a structure that opens for replacement of the cleaning sheet.

6. The cleaning tool for optical fiber connectors according to claim 5,

wherein

the case comprises a main case formed integrally the first front plate with the perimeter  
20 wall, and the second front plate attached detachably from the main case.

7. The cleaning tool for optical fiber connectors according to claim 6,

wherein

the main case has a plurality of hinge hooks and the second front plate defines a

plurality of retaining holes guiding the corresponding hinge hooks.

8. The cleaning tool for optical fiber connectors according to claim 6,

wherein

5 the case has stoppers, the stoppers comprising at least one male stopper disposed with projecting on the side surface of the second front plate and a female stopper provided on the perimeter wall of the main case for retaining the corresponding male stopper to be inserted.

10 9. The cleaning tool for optical fiber connectors according to claim 1,

wherein

the cleaning tool has a holding plate provided inside of window for cleaning for supporting the back of the cleaning sheet.

15 10. The cleaning tool for optical fiber connectors according to claim 1,

wherein

the cleaning tool has an intermediate window sheet disposed in the window for cleaning facing the back of the cleaning sheet .

20 11. The cleaning tool for optical fiber connectors according to claim 10,

wherein

the intermediate window sheet defines an opened window opening through in the center such that a passing space for passing the cleaning sheet is formed between the intermediate window sheet and the holding plate.

12. The cleaning tool for optical fiber connectors according to claim 1,  
wherein

a shutter is provided in the window for cleaning.

5

13. The cleaning tool for optical fiber connectors according to claim 12,  
wherein

the shutter is operated by the lever to close the window for cleaning when not in use.

10 14. The cleaning tool for optical fiber connectors according to claim 12,  
wherein

the shutter is guided its both edge to guide grooves formed on the inner surface of the  
first front plate and the second front plate to be able to slide.

15 15. The cleaning tool for optical fiber connectors according to claim 1,  
wherein

the winding pulley is made of plastics formed integrally with slit axis and a disciform  
outer plate which connects one side of the slit axis.

20 16. The cleaning tool for optical fiber connectors according to claim 1,  
wherein

the case integrally forms a feeding axis made of plastics on the first front plate to set the  
cleaning sheet at a predetermined position.

17. The cleaning tool for optical fiber connectors according to claim 16,

wherein

the cleaning sheet is provided on a feeding pulley set on the feeding axis, and a reverse preventing arm is provided to connect the first front plate for preventing the feeding pulley  
5 from reversing.

18. The cleaning tool for optical fiber connectors according to claim 17,

wherein

the feeding pulley has a reverse preventing gear disposed on the back of the disc, the  
10 reverse preventing gear preventing the feeding pulley from reversing by catching the end  
of the reverse preventing arm.

19. The cleaning tool for optical fiber connectors according to claim 1,

wherein

15 the rotating mechanism comprises a rack having a circular arc shaped gear  
associated with the lever, a back-and-forth rotating plate having pinion to bite the rack,  
and a ratchet equipment for rotating the winding pulley in one direction by rotation of the  
back-and-forth rotating plate; and

operation of the lever rotates the back-and-forth rotating plate via the rack, and  
20 the back-and-forth rotating plate rotates the winding pulley in one direction via the ratchet  
equipment.

20. The cleaning tool for optical fiber connectors according to claim 19,

wherein

the lever integrally forms the rack made of plastics.

21. The cleaning tool for optical fiber connectors according to claim 19,

wherein

5           the back-and-forth rotating plate integrally forms a disc plate and a pinion made of plastics;

          the disc plate defines a pierced hole in center thereof; and

          a round rib formed integrally with the first front plate inserts rotatably into the pierced hole to rotatably connect the back-and-forth rotating plate with the first front plate.

10

22. The cleaning tool for optical fiber connectors according to claim 21,

wherein

          an openable shutter is provided in the window for cleaning,

          the back-and-forth rotating plate has a crankpin to open and close the shutter,

15          the shutter has a slit extending in traverse direction to the direction to open and close the shutter,

          the slit joins to the crankpin disposed in the back-and-forth rotating plate to open and close the shutter by the back-and-forth rotating plate.

20          23. The cleaning tool for optical fiber connectors according to claim 19,

wherein the ratchet equipment comprises:

          a ratchet pulley for attaching the winding pulley;

          an elastic rotating arm rotating the ratchet pulley in one direction; and

          a stopper arm preventing the ratchet pulley to reverse,

wherein one end of the elastic rotating arm is joined to the back-and-forth rotating plate to connect the stopper arm with the case.

24. The cleaning tool for optical fiber connectors according to claim 23,

5 wherein

the winding pulley detachably connects the ratchet pulley, the cleaning sheet wound around the winding pulley can be removed from the winding pulley removed from the ratchet pulley.

10 25. The cleaning tool for optical fiber connectors according to claim 23,

wherein

the ratchet pulley is made by plastics formed overall integrally, and has a spline axis for attaching to the winding pulley on an upper surface of a disc and a ratchet ring having ratchet gears in both side of inside and outside on a outline of a lower surface of the disc

15 with projecting.

26. The cleaning tool for optical fiber connectors according to claim 23,

wherein

the end of the elastic rotating arm joins to an inner ratchet gear, and the end of the  
20 stopper arm joins to an outer ratchet gear in the of a ratchet ring.

27. The cleaning tool for optical fiber connectors according to claim 26,

wherein

the end of the elastic rotating arm is curved along with the direction of the rotation of the

inner ratchet gear.

28. The cleaning tool for optical fiber connectors according to claim 26,  
wherein

5 the end of the stopper is curved along with the direction of the rotation of the ratchet pulley.

29. The cleaning tool for optical fiber connectors according to claim 1,  
wherein

10 the lever is thrust toward direction to project from the opened portion by an elastic part when the lever is not operated by hand.

30. The cleaning tool for optical fiber connectors according to claim 29,  
wherein

15 the lever has a projection projecting against the first front plate,  
a guiding groove guiding the projection is defined in the first front plate such that the incline angle of the lever is limited by the contact of the projection with touching to the both end of the guiding groove.

31. A cleaning tool for optical fiber connectors substantially  
as hereinbefore described with reference to the accompanying  
drawings.



Application No: GB 0105239.8  
Claims searched: 1 to 31

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## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A4F (FNX, F30X)

Int Cl (Ed.7): A47L (25/00) B08B (11/00) G02B (6/25)

Other: Online: WPI, EPODOC, PAJ

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	EP 0391111 A1 (NIPPON TELEGRAPH) see whole document especially figs.3, 10 and 12	1, 3, 5, 9, 12, 14, 29
Y	US 5836031 (MINNESOTA MINING) see whole document, especially column 8 line 37 to column 9 line 4 and fig.6	1, 3, 5, 9, 12, 14, 29
Y	US 5768738 (DAEWOO TELECOM) see whole document	1, 3, 5, 9, 12, 14, 29

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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